

## CLAIMS

1. A robot control device for controlling a robot having a microphone, an imaging device and a self-position detection device, comprising:

- 5           a voice recognition part for recognizing the designation content of a designator based on sounds collected by the microphone;  
          an image recognition part for recognizing the designation content of the designator based on an image imaged by the imaging device;
- 10           a self-position estimation part for estimating the current position of the robot based on an output from the self-position detection device;  
          a map data base for retaining map data registering at least the position of an obstacle;
- 15           a decision part for deciding whether the movement to a specific position is required based on the recognition result of the voice recognition part and image recognition part;  
          a movement ease decision part for deciding movement ease to the specific position based on the current position estimated by  
20   the self-position estimation part and the map data when the decision part decides that the movement to the specific position is required;  
          a behavior decision part for deciding the behavior according to the movement ease decided by the movement ease decision part;  
          and
- 25           a behavior control part for executing the behavior according to the decision of the behavior decision part.

2. The robot control device according to claim 1, wherein the

movement ease decision part reads the position of the obstacle surrounding the movement route to the specific position from the map data base, and sets at least two or more areas based on the distance from the obstacle, and the behavior decision part decides  
5 the behavior according to an area containing the specific position and an area where the robot exists.

3. The robot control device according to claim 1, wherein the movement ease decision part including:

10 an obstacle recognition part for recognizing the obstacle surrounding the movement route to the specific position from the current position of the robot estimated by the self-position estimation part and the map data;

a warning area set part for setting an area having a possibility  
15 to interfere with an obstacle as a warning area when the robot exists, based on the position of the obstacle recognized by the obstacle recognition part;

a margin area set part for setting an area with a predetermined distance from the warning area as a margin area; and

20 a safety area set part for setting an area distant from the margin area from the obstacle as a safety area, and wherein

the movement ease to the specific position is decided based on the area including the specific position and the area where the robot exists, respectively, applicable to either one of the warning  
25 area, the margin area and the safety area.

4. The robot control device according to claim 3, wherein the warning area set part decides the position of a circle where a distance

between representative points of the surface of the obstacle is set as a diameter, and sets the warning area using the position of the circle.

5     5.     The robot control device according to claim 1, wherein the behavior decision part decides at least any one behavior of movement, the response of movement refusal, the reconfirmation of designation, stop, deceleration and acceleration.

10    6.     The robot control device according to claim 1, wherein the voice recognition part has a designating range specification part for narrowing a designating area using a reference term, and the behavior decision part recognizes a specific position from the area of the logical product of the designating area narrowed by the  
15    designating range specification part and designating area recognized by the image recognition part.

7.     The robot control device according to claim 1, further comprising a behavior schedule transmission part for making the  
20    behavior control part output a behavior schedule.

8.     A robot control method for controlling a robot having a microphone, an imaging device and a self-position detection device, comprising the steps of:

25         a designation content discriminating step of recognizing the designation content of a designator based on sounds collected by the microphone, recognizing the designation content of the designator based on an image imaged by the imaging device, estimating

the current position of the robot based on an output from the self-position detection device, and deciding whether the designation of the movement to a specific position is required from the designation content recognized by the sounds and the designation  
5 content recognized from the image;

a movement ease deciding step of deciding the movement ease to the specific position based on the current position estimated based on the output from the self-position detection device and map data provided as a map data base and registering at least the  
10 position of an obstacle when the designation content discriminating step decides that the movement to the specific position is required;

a behavior deciding step of deciding the behavior according to the movement ease decided by the movement ease deciding step; and

15 a behavior controlling step of executing the behavior according to the decision of the behavior deciding step.

9. The robot control method according to claim 8, wherein the movement ease deciding step reads the position of the obstacle  
20 surrounding the movement route to the specific position from the map data base, and sets at least two or more areas based on the distance from the obstacle, and

the behavior deciding step decides the behavior according to an area including the specific position and an area where the robot  
25 exists.

10. The robot control method according to claim 8, wherein the movement ease deciding step includes:

an obstacle recognizing step of recognizing the obstacle surrounding the movement route to the specific position from the current position of the robot estimated based on the self-position detection device and the map data;

5        a warning area setting step of setting an area having a possibility to interfere with an obstacle when the robot exists based on the position of the obstacle recognized by the obstacle recognizing step as a warning area;

10       a margin area setting step of setting an area with a predetermined distance from the warning area as a margin area;

a safety area setting step of setting an area distant from the margin area from the obstacle as a safety area; and wherein

15       a step of deciding the movement ease to the specific position based on the area including the specific position and the area where the robot exists, respectively applicable to either one of the warning area, the margin area and the safety area.

11.    The robot control method according to Claim 10, wherein the warning area setting step decides the position of a circle where  
20    a distance between representative points of the surface of the obstacle is set as a diameter, and sets the warning area using the position of the circle.

12.    The robot control method according to claim 8, wherein the  
25    behavior deciding step decides at least any one behavior of movement, the response of movement refusal, the reconfirmation of designation, stop, deceleration and acceleration.

13. The robot control method according to claim 8, wherein the designating content recognizing step includes a designating range specifying step of narrowing a designating area using a reference term contained in the sound, and an image recognizing step of  
5 narrowing the designating area from the image, and the behavior deciding step recognizes the specific position from the area of the logical product of the designating area narrowed by the designating range specifying step and designating area recognized by the image recognizing step.

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14. The robot control method according to claim 8, wherein the behavior controlling step has a behavior schedule transmitting step for outputting the behavior schedule decided by the behavior deciding step.

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15. A robot control program for making a computer mounted on a robot execute a method according to any one of claims 8 to 14 so as to control the robot having a microphone, an imaging device and a self-position detection device.

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16. A robot control program for making a computer mounted on a robot function as a voice recognition means for recognizing the designation content of a designator based on sounds collected by a microphone,

25 an image recognition means for recognizing the designation content of the designator based on the image imaged by an imaging device,

a self-position estimation means for estimating the current

position of the robot based on the output from the self-position detection device,

a decision means for deciding whether the movement to a specific position is required based on the recognition result of the voice  
5 recognition means and image recognition means, and the current position of the robot estimated by the self-position estimation part,

a movement ease decision means for deciding the movement ease to the specific position based on the current position estimated  
10 by the self-position estimation means and map data provided as a map data base and registering at least the position of an obstacle when the decision means decides that the movement to the specific position is required, and

a behavior decision means for deciding the behavior according  
15 to the movement ease decided by the movement ease decision means so as to control the robot having the microphone, the imaging device and the self-position detection device.